of dynamite are here clearly emphasized by Professor A. P. Knight. Professor Knight does not, however, find the effect of sawdust as injurious as has been hitherto supposed. A strong solution of sawdust poisons fish and fish fry, through the agency of compounds dissolved out of the wood cells. Fishes will desert a river polluted with freshly made sawdust, going down stream or into tributaries to escape from the disagreeable influence of the sawdust extracts. Waste matters which would be deadly in one river will pass away and prove of little harm in another, where the conditions are different.

In the *Journal of Morphology* (1908), Reighard and Mast describe the development of the hypophysis of Amia.

In the *Journal of Experimental Zoology* (1909), Professor C. R. Stockard describes the development of the young of *Fundulus heteroclitus* in magnesian solutions instead of salt water. The result is the development of cyclopean fish, with a single coalesced eye on the top of the head. It is thought that magnesia possesses an anesthetic effect, and is inhibitory in its influence on muscular activity. It, therefore, retards the outpushing of the eyes in the embryo, leaving the eyes without energy for perfect development, and at times without energy sufficient for their normal separation.

In the *Outing Magazine* (September, 1908), Bonnycastle Dale describes the mystery of the salmon, and its desperate struggle to breed in the waters of the Columbia, with some excellent photographs.

Under the head of "The Fishes of Japan," Otaki, Fujita and Higurashi continue their fifth volume of discussion of the Japanese fisheries and fishing methods. The fourth volume contains colored plates of a number of Japanese food fishes. The text is entirely in Japanese.

DAVID STARR JORDAN.

PARASITOLOGY

The question as to the relation of the tse-tse fly which is absolutely demonstrated to be the transmitting agent of sleeping sickness and the parasite of the disease is one that has been discussed pro and con with great vigor. Minchin and others contend most powerfully that the fly is a mere mechanical vector while Manson and his supporters, chiefly, it must be confessed,

from a theoretical standpoint, have maintained that the fly stood in the same relation to the disease as the mosquito held to malaria. As already indicated, the definite evidence thus far secured has seemed to favor the view that the fly is a mere mechanical agent. Some recent experiments in East Africa are of tremendous importance in this discussion. Kleine[1] under date of December 28, 1908, reports from Kirugu, German East Africa, an experiment which apparently demonstrates that flies may infect after a long interval. Heretofore it has been claimed that flies would not infect later than forty-eight hours after biting infected hosts. A longer interval is good evidence of the existence of a developmental cycle in the fly. Kleine's experiment may be summarized as follows:

Nagana, an animal disease due to *Trypanosoma Brucei,* does not occur in the Kirugu region. Animals which had been naturally infected by the bite of the tse-tse fly, *Glossina morsitans,* were brought from a locality seven days' march distant and were kept in isolation. Other flies, *Glossina palpalis,* caught on the Mori River, were fed for three days on the infected animals and from the fourth to the seventeenth day inclusive for each day on a fresh healthy animal. From the eighteenth to the twenty-fourth day the flies fed on a single sheep; from the twenty-fifth to the twenty-ninth day on a single ox. Frequent blood examinations were made of the experimental animals and on the twelfth day after the flies were put on the ox which was first used on the twenty-fifth day of the experiment, numerous trypanosomes were found in the blood of this host. Then the sheep first employed as host on the eighteenth day was examined and found also to be infected. All the other experimental animals remained uninfected. Goats, calves and sheep were used to feed the flies from the fortieth to the fiftieth day and all were infected. The author concludes: "From this it is seen that flies which for many days after the ingestion of blood containing trypanosomes were not infective, afterwards became so and infected a sheep and then an ox."

The Royal Society has received a telegram dated April 3 from Colonel Sir David Bruce which announces the confirmation of Kleine's observations, and a letter received April 30, dated Mpumu, Chagwe, Uganda, April 3, confirms the cablegram

[1] "Positive Infektionsversuche mit *Trypanosoma Brucei* durch *Glossina palpalis.*" *Deutsche medizinische Wochenschrift,* 18 Marz, 1909; 469–470.

notice and says that the Commission had "repeated Dr. Kleine's experiments with *Trypanosoma gambiense* and *Glossina palpalis,* also with a trypanosome of the *dimorphon* type and the same tse-tse flies and found the flies infective after 16, 19 and 22 days."

It is apparently impossible to escape the conclusion that the parasite of human sleeping sickness, *Trypanosoma gambiense,* also undergoes a cycle of development in its transmitting agent, *Glossina palpalis*, and that the fly bears the same relation to the parasite which the mosquito does to the malarial organism. It is unnecessary to indicate in detail the tremendous importance of this discovery.

Old fables die hard and among them must be placed the oft-repeated story cited in many modern texts of good standing that in some parts of Italy and France the population makes use of certain fish tapeworms (Ligula) which are found in the body cavity of various cyprinids, as a delicacy under the name of macaroni piatti or ver blanc. In 1894 Monticelli demonstrated the incorrectness of the story, but it continues to be cited as a biological marvel even by recent writers of repute. Recently Parona has again exploded the myth in an interesting brochure entitled "Les Liguliphages ou soi-distant mangeurs des ligules."[1] Nowhere in Italy is such a habit found; the error is as persistent as false and deserves general contradiction until it is finally eliminated from our text-books. Rudolphi reported that at times the Ligulæ are eaten with the tench which they infest, being taken for the fat of the fish. From such a simple beginning the fable grew until it was said that certain fish culturists raised tench to obtain the ligulæ which they harbored. The final stamp of reality was imparted to the fable when a French savant wrote that these biological noodles are eaten at Lyons as in Italy!! Like the tales of early naturalists, which Linné copied so faithfully, that tapeworms occur in brooks and springs, so let the marvellous story of the liguliphages be consigned to the care of writers on unnatural history and forever more be eliminated from serious consideration.

Sambon and Seligman[2] have recorded studies on the hæmogregarine of reptiles, describing many new species and affirming

[1] *Bull. pop. pisiculture,* n. s., 4.

[2] *Jour. Trop. Med.,* December, 1908.

that their life history manifests two cycles; the schizogonic or vegetative cycle, in the blood of vertebrates and characterized by asexual multiplication with the sporogonic, characterized by sexual reproduction. They enumerate merozoites, schizonts, sporonts, etc. Patton[3] recounting his work on the same objects states that careful feeding operations with larval nymphal and adult ticks under most favorable conditions at the King Institute, Madras, and several years' study of similar parasites in amphibia and their transmitting leeches, for comparative purposes, have entirely failed to elucidate the extra-corporeal life histories of the intracellular parasites of either reptiles or mammals. He regards the transmission of these parasites as mechanical and questions the interpretation of the different forms described by the other authors from the peripheral blood of snakes. He inclines to consider all their forms as belonging to a single species of hæmogregarine and in closing calls attention to Prowazek's error in regarding cysts found in a pentastome from a python as developmental stages of *Hæmogregarina pythonis* when in reality they represent part of a cycle of a parasite peculiar to the pentastome and have nothing to do with the hæmogregarine of the snake. Patton might have cited numerous similar cases of confusion between normal parasites of a supposed transmitting agent and the missing developmental stages of the parasite under investigation.

In the same journal[4] Patton gives a brief though valuable résumé of the genus *Herpetomonas* which emphasizes certain points of great importance in this connection. These flagellates are parasitic in the alimentary tract of insects, though those which occur in blood-sucking insects are in no wise related to blood parasites. Their developmental cycle consists of a preflagellate, a flagellate and a postflagellate stage. The preflagellate stage presents round or oval bodies with nucleus and blepharoplast, multiplies by simple longifission or multiple segmentation, and occurs in the insect's mid gut. In the flagellate stage the organism forms a single flagellum and is found in both mid gut and hind gut, while the postflagellate stage is characterized by massing of the herpetomonads in the midgut and the formation of cysts which pass out in the feces. Many are undistinguishable in their preflagellate stages and a partial study

[3] *Parasitology,* December, 1908.

[4] *Parasitology,* December, 1908.

may lead to confusion of true herpetomonads with Crithidia or young trypanosomes, such as has actually occurred in more than one instance.

He closes thus:

As the life-cycles and general structure of the three human parasites are similar to those of well-known Herpetomonads, I see no reason for placing them in a distinct genus. The differences in their development, such as the formation of the flagellum, methods of division and the fact that their preflagellate stages are passed in man only justify their being regarded as specifically distinct from such species as *H. muscæ-domesticæ, H. sarcophagæ, H. culicis, H. lygæi* and many others.

In the opinion of others, just the points noted justify including the three human parasites in a separate genus, Leishmania.

H. B. WARD.

PLANT CYTOLOGY

The Permanence of Chromosomes in Plant Cells.—The problem of the individuality of the chromosome is receiving the attention of a number of plant cytologists. Briefly stated the problem concerns the permanence of the chromosome as an organ of the cell, enquiring whether the chromosomes are present as structural entities in the resting nucleus and whether they have come down from a line of ancestral structures reproducing by fission in the mitoses throughout the life histories.

In 1904 Rosenberg presented claims that the chromosomes may be recognized in the resting nuclei of certain plants and cited *Capsella bursa-pastoris* as a favorable type for their demonstration. Overton in 1905 traced the chromosomes of certain dicotyledons to aggregates of chromatin in the resting nuclei which he designated as prochromosomes, believing them to be autonymous structures representing the chromosomes in this stage of nuclear activity. Other investigators have reached similar conclusions. Nevertheless a number of plants is known in which the forms of the chromosomes during the interkineses are so changed by progressive alveolization or vacuolization as well as by the reticular union of chromatic masses through anastomoses that the outlines of the structures can not be followed in the irregularities of the chromatic and linin network. Whether the chromosomes in such nuclei really lose their identity as autonymous structures is not of course established simply by the negative evidence that they have not been traced